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<p>(54) Title: A METHOD, AN ARRANGEMENT AND A CHEMICAL AGENT FOR MARKING OF BANKNOTES, VALUABLE DOCUMENTS ETC. AND DETECTION EQUIPMENT OF SUCH A MARKING</p>		
<p>(57) Abstract</p> <p>The invention relates to a method, an arrangement and a solution for the marking of banknotes or securities (9, 17, 18) with a coating which is invisible to the naked eye under normal lighting. The coating, which can be executed in the form of a bar code, consists of a colourless polymer solution with a matt surface structure in the dry state, which solution is mixed with fluorescent substances, preferably consisting of colourless flakes, which can be caused to give off fluorescent light when they are illuminated with UV light. The invention also relates to an installation for the detection of such marking.</p>		

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A METHOD, AN ARRANGEMENT AND A CHEMICAL
AGENT FOR MARKING OF BANK-NOTES, VALUABLE
DOCUMENTS ETC. AND DETECTION EQUIPMENT OF
SUCH A MARKING

10 In connection with bank robberies, for example, it is practically impossible at the present time to trace the banknotes stolen by a robber, in spite of the fact that the series of numbers may have been recorded at the branch in question. It has previously been suggested that all banknotes issued by the Bank of Sweden should be
15 recorded on computer, and that all banks and post offices should be connected to a recording system of this kind for the purpose of controlling the flow of bank notes. A solution of this kind is not entirely realistic, however, since an enormous amount of computer power would be required for daily control functions and for any
20 necessary tracing of banknotes which had come into circulation as the result of a robbery.

The present invention relates to a solution of the problem in question, and is based essentially on every till in a bank being
25 equipped with issuing devices for banknotes, which means that banknotes can never be handed to anyone without being issued mechanically from a supply of banknotes which must be kept securely closed. In the event of a robbery situation arising, the cashier presses a button to cause the banknotes to be issued. The control
30 button may be executed in such a way that it requires to be depressed to a certain position for the normal issue of notes, but that in the event of danger it is depressed to a bottom position, in conjunction with which, as the notes are issued, an arrangement is actuated for the purpose of applying a colourless coating
35 comprising fluorescent substances, in such a way that markings forming an identifiable code, preferably a so-called bar code, are

produced. The coating is caused to dry quickly by being passed through a radiation source, whereupon the coating in question is entirely invisible when viewed in ordinary light.

5 If, on the other hand, the banknotes in question are illuminated with ultraviolet radiation or radiation of a certain pre-determined wavelength, the marking will become apparent through the fluorescent characteristics of the coating. This means that a receiving cashier's station, for example a post office or another
10 bank, is able, by illuminating the banknotes with such radiation, to detect the presence of marking executed in the aforementioned manner, and is also able easily to identify the issuing bank, so that the robber can be linked to the robbery which has been committed.

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The characterizing features of the present invention can be appreciated from the following Patent Claims.

20 The invention is described below in greater detail with reference to an illustrative embodiment and to the accompanying drawing.

Fig. 1 illustrates in perspective view an arrangement for the issue and marking of banknotes.

25 Fig. 2 illustrates an installation for the detection of marking on banknotes.

The arrangement illustrated in Fig. 1 consists of a holder 1 containing sorted banknotes, together with an electro-mechanical
30 issuing device (not shown here) for the issue of one banknote at a time.

Present at the discharge end 2 of the holder is a conveyor track 3, in conjunction with which spray devices 4, 5, for example in the
35 form of so-called ink-jet printers, are arranged to either side of the conveyor belt. A container 6 under pressure supplies a

colourless liquid mixture via tubes 7, 8 to the spray devices 4, 5. The aforementioned spray devices are so arranged as to spray out curtains 9 for the purpose of forming bar-shaped coatings 9' on a banknote 10 which is issued from the magazine 1 in the direction P of the arrow. The conveyor track 3 is, of course, provided with an opening (not shown here), so that the spray device 5 can coat the underside of the banknote 10 as it is transported past same. An electronic control device 11, which is connected to the respective spray devices via cables 12, 13, is provided for the purpose of controlling the flow of the coating fluid. The control device 11 is appropriately connected to a computer device 15 via a cable 14.

Once the banknote 10 has been fed through the coating points, that is to say past the spray devices 4, 5, it is necessary to dry the applied coating rapidly. This is done in an arrangement 16, which appropriately comprises UV radiation sources (not shown here) or other radiation devices for the purpose of causing instantaneous drying of the coatings in question. As can be appreciated from Fig. 1, a banknote 17 has been issued, the coating on which has been dried so that the bar code present thereon is invisible in normal lighting. The banknote which has been issued is accordingly marked, and is in actual fact marked with a bar code which identifies the point of issue and the bank at which its issue took place.

In the event of a banknote which has been marked in this way being tendered in payment, the operator concerned can check whether or not the banknote in question is marked with a bar code. As will be appreciated from Fig. 2, a marked banknote 18 can be introduced into an arrangement between two UV light sources 19, 20 in an installation into which banknotes can be fed. The bar code will emit light through fluorescence, which light can then be detected by means of photo-detectors 21, 22, which are connected to a detector installation 23, which in turn controls an alarm signal 24 and an identification installation 25 connected to a computer network, for example. The operator can consequently obtain an immediate indication of any markings which are present on the

banknote, and is able in this way rapidly to trace the bank from which they originated and, furthermore, to take the appropriate measures to involve the police, etc.

- 5 The coating which is to be applied to the banknotes must be matt and colourless in the dried state and may appropriately be in the form of a polymer liquid mixed together with fluorescent flakes. This liquid mixture is introduced into the container 6, from where it is supplied via the tubes 7, 8 to the spray devices 4, 5. A
 10 lacquer which lends itself in this way to the coating of paper, and which will dry in the presence of UV radiation, can consist of various forms of acrylate, for example acrylated epoxy, polyester acrylates, urethane acrylates, amino acrylates and acrylate monomers. Other additives include photo-initiators, delustering
 15 agents, release agents, various additives to improve levelling and drying, and possibly a solvent.

For example, a matt fluorescent lacquer can have the following composition:

20		%
	Acrylated epoxy	15
	Di-functional acrylate	45
	Tri-functional acrylate	3
	Amino acrylate (accelerator)	10
25	Photo-initiator	5
	Hardening initiator	1
	Delustering agent	10
	Levelling aid	0.5
	Release agent	0.5
30	Ethyl acetate	10

An optical brightener is also added at a concentration of 0.1% of the dry content.

- 35 A lacquer of this kind has a low gloss of 10-15% at an angle of reflection of 60°. The viscosity is low, equivalent to 25 s with Ford cup B4.

By using a mercury lamp (medium pressure) it is possible to achieve an application rate of 50 m/min. The lacquer is such that it must be kept in contact with air/oxygen in order to prevent polymerization. This means that the container 6 must not be filled to the top.

It is obvious that other appropriate coatings are also conceivable within the scope of the invention. The bar-coded coating can also be applied by a method other than that described above, of course, for example by stamping, painting, etc. Embodiments are conceivable which directly trigger an alarm at a police station and at the bank branch as soon as a marked banknote is tendered for deposit. Consequently the present invention enables banknotes or securities which have been involved in a robbery or theft to be traced easily without the need to use excessive computer power, and without the need to involve large amounts of equipment. The invention allows stolen banknotes or securities to be traced easily, and their origin to be identified. The coating liquid described here can, of course, also be used in containers and magazines for the storage of banknotes, which are fitted with pressure spray devices with a trigger facility by means of which the devices can be actuated so as to coat the banknotes in the event of theft.

In order to detect the presence of a coating on banknotes or securities, it is not necessary for the inspection point to be equipped with an installation of the kind referred to above, and a unit which emits UV light will be sufficient in many cases.

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P A T E N T C L A I M S

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1. Method for use in given situations, such as robberies and similar, for the invisible marking of banknotes or securities, characterized in that they are coated, for example as they are issued from a banknote magazine, with a colourless solution,
10 suspension or similar comprising fluorescent substances which can be caused to fluoresce actively by being illuminated with light at a particular wavelength, in which case the solution or the suspension dries to form a colourless polymer coating, which is invisible when viewed in ambient lighting conditions, applied in
15 the form of marks producing an identifiable code, appropriately a so-called bar code.

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2. Method according to Claim 1, characterized in that the solution is applied by spraying, printing or painting.

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3. Arrangement for the execution of the method in accordance with any of the preceding Claims, characterized in that it consists of a feed arrangement for the issue of banknotes (1, 3) or securities, which arrangement is provided with devices (4, 5) which
25 are capable of being activated in given situations, such as robberies and similar, for the application by spraying, printing or painting of a coating (9) consisting of a colourless solution, suspension or similar comprising fluorescent substances, and is provided with a device (16) for the rapid drying of the solution
30 constituting the coating, in conjunction with which spray nozzle devices (4, 5) are arranged at the banknote discharge opening and are so arranged as to be controlled by a control circuit (11) in order to produce coatings formed into an identifiable code on the sides of the banknotes.

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4. Arrangement according to Claim 3, characterized in that the feed arrangement is of such a nature that the banknotes

(17) which have been issued, or banknotes (10) in the course of being issued, can be coated by spraying with marks on both sides of the banknote.

- 5 5. Arrangement according to Claim 3, characterized in that the control circuit (11) in turn is controlled preferably by a computer (15), in which case the spray nozzle devices (4, 5) are controlled so as to produce coded information in the form of bars.
- 10 6. Arrangement according to Claims 3, 4 or 5, characterized in that each coated note (10) is caused to pass through a drier installation (16) after coating.
- 15 7. Arrangement according to Claim 6, characterized in that the drier installation (16) comprises one or more radiation sources, preferably for UV light.
- 20 8. Installation for the detection of coatings applied in accordance with any of the preceding Claims to banknotes or securities, characterized by a banknote input installation with one or more light sources (19, 20) for illuminating the coated parts with light at a frequency which produces detectable reflection of the one or more fluorescent coatings.
- 25 9. Installation according to Claim 8, characterized in that detection devices (21, 22) are arranged for the purpose of detecting the presence of coatings, which devices are preferably connected to decoding circuits (23, 25), which in turn are connected to a computer network, for example.
- 30 10. Colourless solution for use in conjunction with the method in accordance with any of the Claims 1-2, characterized in that it consists of acrylate polymers with the addition of photo-initiators, delustering agents, release agents and/or various
- 35 additives, possibly together with a solvent.

11. Colourless solution according to Claim 10, characterized in that the acrylate polymers consist of acrylated epoxy, polyester acrylate, urethane acrylate, amino acrylate or acrylate monomers.

5 12. Colourless solution according to Claim 11, characterized in that it has the following composition:

	%
Acrylated epoxy	15
Di-functional acrylate	45
10 Tri-functional acrylate	3
Amino acrylate (accelerator)	10
Photo-initiator	5
Hardening initiator	1
Delustering agent	10
15 Levelling aid	0.5
Release agent	0.5
Ethyl acetate	10

20 13. Colourless solution according to any of the Claims 10-12, characterized in that an optical brightener is added at a concentration of $\leq 0.1\%$ of the dry content.

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AMENDED CLAIMS

[received by the International Bureau on 1 November 1988 (01.11.88)
claims 8 and 9 cancelled; other claims unchanged but renumbered accordingly (3 pages)]

1. Method for use in given situations, such as robberies and similar, for the invisible marking of banknotes or securities, characterized in that they are coated, for example as they are issued from a banknote magazine, with a colourless solution, suspension or similar comprising fluorescent substances which can be caused to fluoresce actively by being illuminated with light at a particular wavelength, in which case the solution or the suspension dries to form a colourless polymer coating, which is invisible when viewed in ambient lighting conditions, applied in the form of marks producing an identifiable code, appropriately a so-called bar code.
2. Method according to claim 1, characterized in that the solution is applied by spraying, printing or painting.
3. Arrangement for the execution of the method in accordance with any of the preceding claims, characterized in that it consists of a feed arrangement for the issue of banknotes (1,3) or securities, which arrangement is provided with devices (4,5) which are capable of being activated in given situations, such as robberies and similar, for the application by spraying, printing or painting of a coating (9) consisting of a colourless solution, suspension or similar comprising fluorescent substances, and is provided with a device (16) for the rapid drying of the solution constituting the coating, in conjunction with which spray nozzle devices (4,5) are arranged at the banknote discharge opening and are so arranged as to be controlled by a control circuit (11) in order to produce coatings formed into an identifiable code on the sides of the banknotes.

4. Arrangement according to claim 3,
c h a r a c t e r i z e d in that the feed arrangement is
of such a nature that the banknotes (17) which have been
issued, or banknotes (10) in the course of being issued, can
be coated by spraying with marks on both sides of the
banknote.

5. Arrangement according to claim 3,
c h a r a c t e r i z e d in that the control circuit (11)
in turn is controlled preferably by a computer (15), in which
case the spray nozzle devices (4,5) are controlled so as to
produce coded information in the form of bars.

6. Arrangement according to claims 3, 4 or 5,
c h a r a c t e r i z e d in that each coated note (10)
is caused to pass through a drier installation (16) after
coating.

7. Arrangement according to claim 6,
c h a r a c t e r i z e d in that the drier installation
(16) comprises one or more radiation sources, preferably for
UV light.

8. Colourless solution for use in conjunction with the
method in accordance with any of the claims 1-2,
c h a r a c t e r i z e d in that it consists of acrylate
polymers with the addition of photo-initiators, delustering
agents, release agents and/or various additives, possibly
together with a solvent.

9. Colourless solution according to claim 8,
c h a r a c t e r i z e d in that the acrylate polymers
consist of acrylated epoxy, polyester acrylate, urethane
acrylate, amino acrylate or acrylate monomers.

10. Colourless solution according to claim 9,
c h a r a c t e r i z e d in that it has the following
composition:-

	%
Acrylated epoxy	15
Di-functional acrylate	45
Tri-functional acrylate	3
Amino acrylate (accelerator)	10
Photo-initiator	5
Hardening initiator	1
Delustering agent	10
Levelling aid	0.5
Release agent	0.5
Ethyl acetate	10

11. Colourless solution according to any of the claims 8-10,
c h a r a c t e r i z e d in that an optical brightener is
added at a concentration of $\leq 0.1\%$ of the dry content.

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Fig. 1

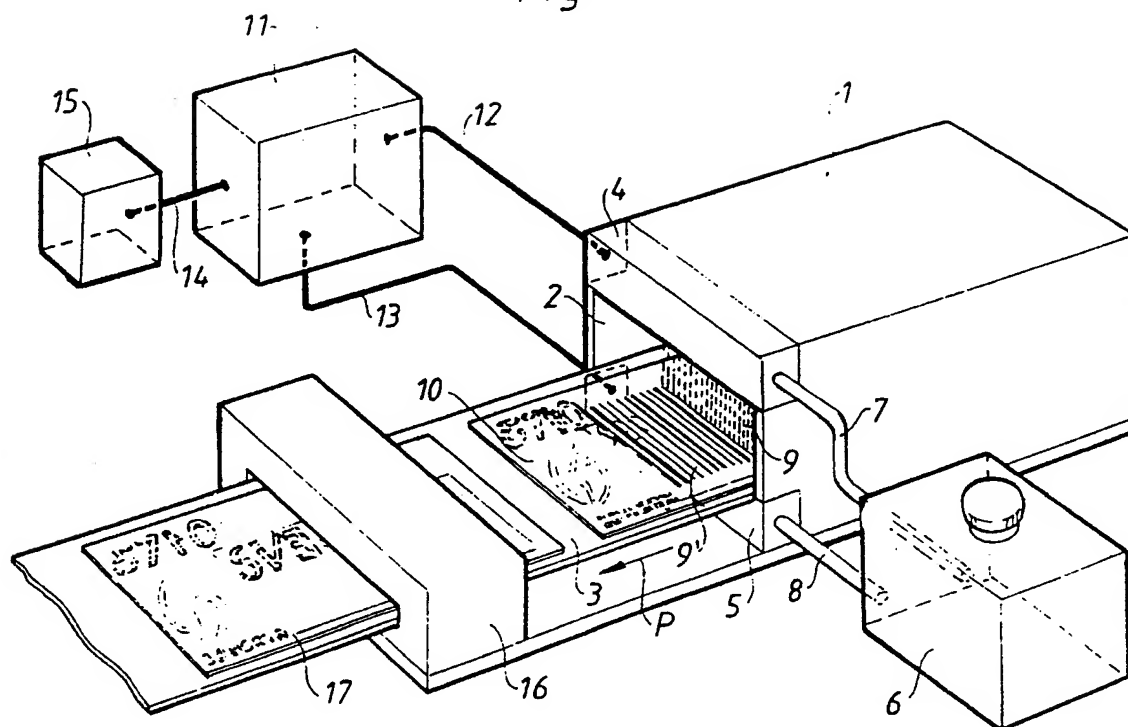
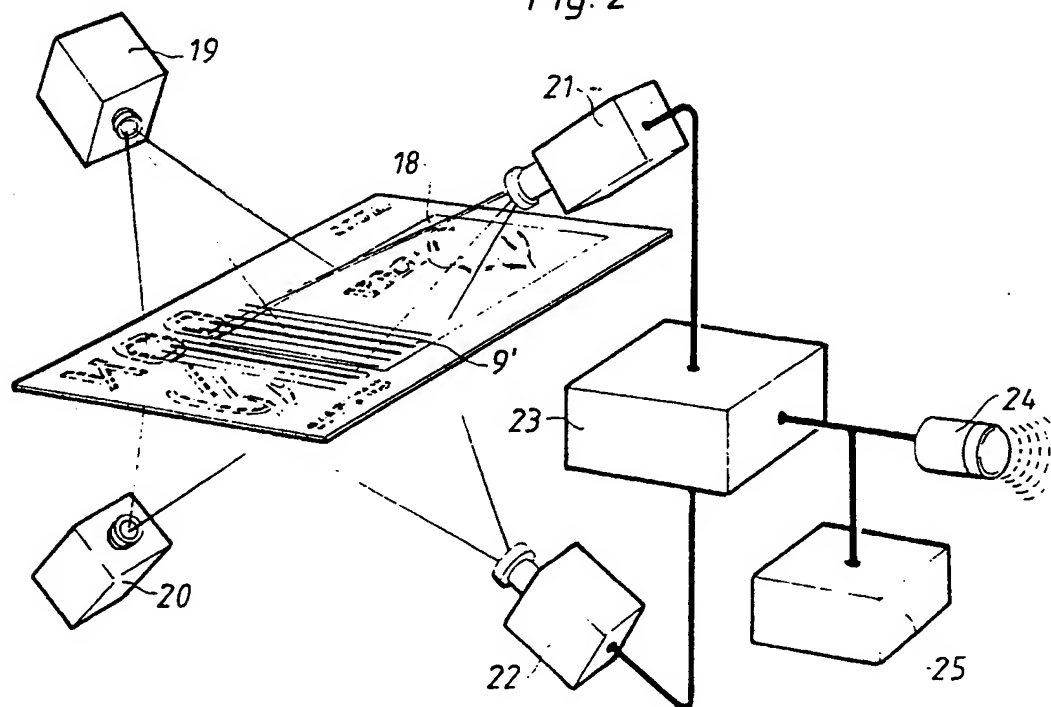


Fig. 2



INTERNATIONAL SEARCH REPORT

International Application No. PCT/SE88/00362

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC ⁴ G 07 D 7/00, B 44 F 1/12, C 09 D 3/80, C 09 D 5/22						
II. FIELDS SEARCHED <div style="text-align: right; font-size: small;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 30%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; vertical-align: top;">IPC 4 US C1</td> <td style="border: none; vertical-align: top;">B 44 F 1/12; C 09 D 3/80, 5/22; E 05 G 1/10, /12; G 07 D 7/00, 9/00 109: 25, 29, 31</td> </tr> </table> <div style="text-align: center; font-size: x-small; margin-top: 5px;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	IPC 4 US C1	B 44 F 1/12; C 09 D 3/80, 5/22; E 05 G 1/10, /12; G 07 D 7/00, 9/00 109: 25, 29, 31
Classification System	Classification Symbols					
IPC 4 US C1	B 44 F 1/12; C 09 D 3/80, 5/22; E 05 G 1/10, /12; G 07 D 7/00, 9/00 109: 25, 29, 31					
SE, NO, DK, FI classes as above						
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹						
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³				
A	Svenska Dagbladet, 14 November 1976, Stockholm, Claes von Hoffsten, page 4, "Uppfinning gör rånbyte från banker värdelöst"	1, 3				
A	US, A, 3 730 110 (PETERS) 1 May 1973, See column 2, lines 51-56	1-3				
A	US, A, 2 940 937 (O'BRIEN) 14 June 1960, See column 2, lines 14-36; column 3, lines 42-49	1, 3, 10				
X	US, A, 4 114 804 (JONES et al) 19 September 1978, See column 5, lines 18-42 & DE, 2731531 JP, 53044089 GB, 1567260 JP, 59135588 SE, 441314 SE, 448036 SE, 448037	8				
A	SE, B, 300 664 (McCAFFERTY) 6 May 1968	10				
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IV. CERTIFICATION						
Date of the Actual Completion of the International Search <div style="text-align: center;">1988-09-06</div>		Date of Mailing of this International Search Report <div style="text-align: center;">1988 -09- 13</div>				
International Searching Authority <div style="text-align: center;">Swedish Patent Office</div>		Signature of Authorized Officer <div style="text-align: center;">Hans Bandelin</div>				